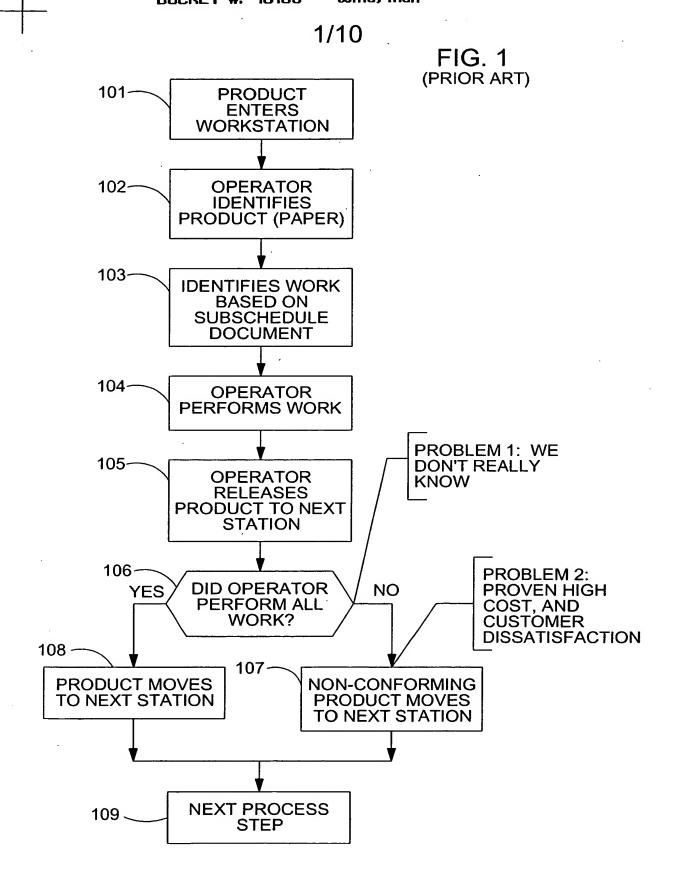TITLE: INFINITELY VARIABLE, ORDER
SPECIFIC, HOLISTIC ASSEMBLY
PROCESS CONTROL SYSTEM
INVENTOR: V rn H ppes, et. al.
DOCKET #: 16166   -wmd, mah

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FIG. 1
(PRIOR ART)

101 — PRODUCT ENTERS WORKSTATION

102 — OPERATOR IDENTIFIES PRODUCT (PAPER)

103 — IDENTIFIES WORK BASED ON SUBSCHEDULE DOCUMENT

104 — OPERATOR PERFORMS WORK

105 — OPERATOR RELEASES PRODUCT TO NEXT STATION

PROBLEM 1: WE DON'T REALLY KNOW

106 — DID OPERATOR PERFORM ALL WORK?   YES   NO

PROBLEM 2: PROVEN HIGH COST, AND CUSTOMER DISSATISFACTION

108 — PRODUCT MOVES TO NEXT STATION

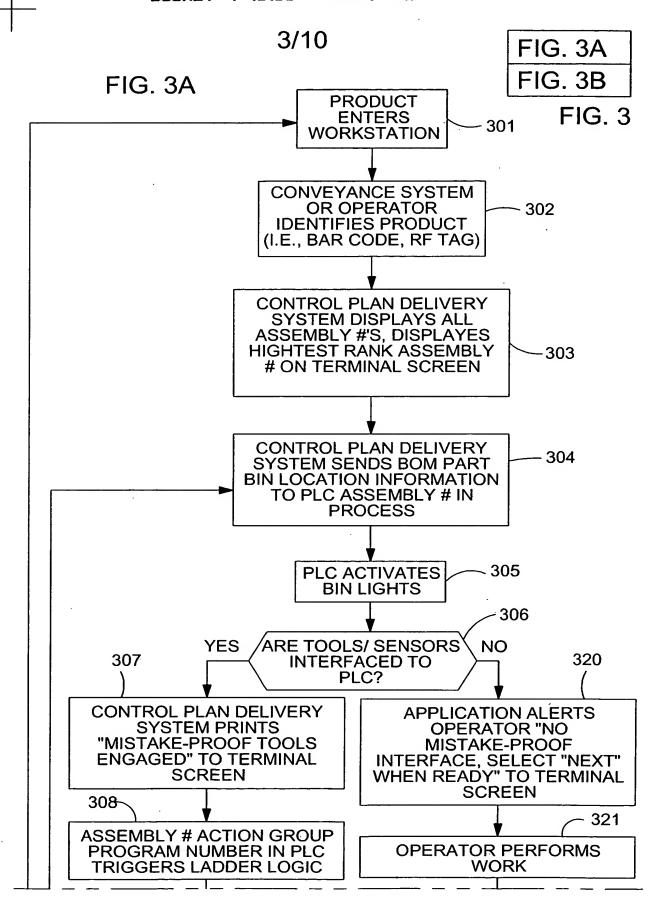107 — NON-CONFORMING PRODUCT MOVES TO NEXT STATION

109 — NEXT PROCESS STEP

TITLE: INFINITELY VARIABLE, ORDER
SPECIFIC, HOLISTIC ASSEMBLY
PROCESS CONTROL SYSTEM
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STOP/ RELEASE
CONTROL

TOOLS   PRODUCT   PARTS

FIG. 2

TITLE: INFINITELY VARIABLE, ORDER
SPECIFIC, HOLISTIC ASSEMBLY
PROCESS CONTROL SYSTEM
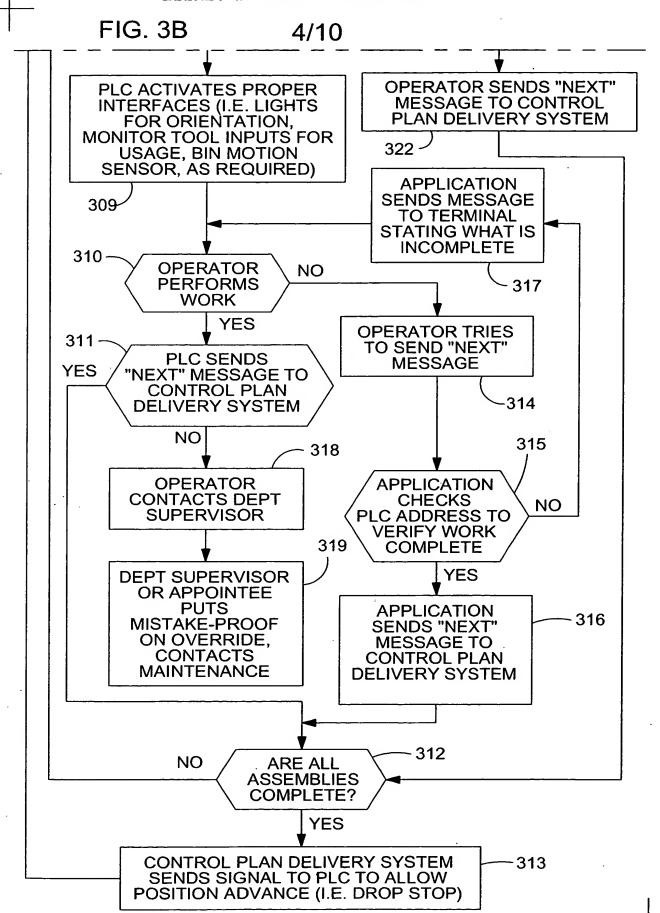INVENTOR: V rn Hoppe , et. al.
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FIG. 3A

FIG. 3A
FIG. 3B

FIG. 3

PRODUCT ENTERS WORKSTATION — 301

↓

CONVEYANCE SYSTEM OR OPERATOR IDENTIFIES PRODUCT (I.E., BAR CODE, RF TAG) — 302

↓

CONTROL PLAN DELIVERY SYSTEM DISPLAYS ALL ASSEMBLY #'S, DISPLAYES HIGHTEST RANK ASSEMBLY # ON TERMINAL SCREEN — 303

↓

CONTROL PLAN DELIVERY SYSTEM SENDS BOM PART BIN LOCATION INFORMATION TO PLC ASSEMBLY # IN PROCESS — 304

↓

PLC ACTIVATES BIN LIGHTS — 305

↓

ARE TOOLS/ SENSORS INTERFACED TO PLC? — 306

YES →

CONTROL PLAN DELIVERY SYSTEM PRINTS "MISTAKE-PROOF TOOLS ENGAGED" TO TERMINAL SCREEN — 307

↓

ASSEMBLY # ACTION GROUP PROGRAM NUMBER IN PLC TRIGGERS LADDER LOGIC — 308

NO →

APPLICATION ALERTS OPERATOR "NO MISTAKE-PROOF INTERFACE, SELECT "NEXT" WHEN READY" TO TERMINAL SCREEN — 320
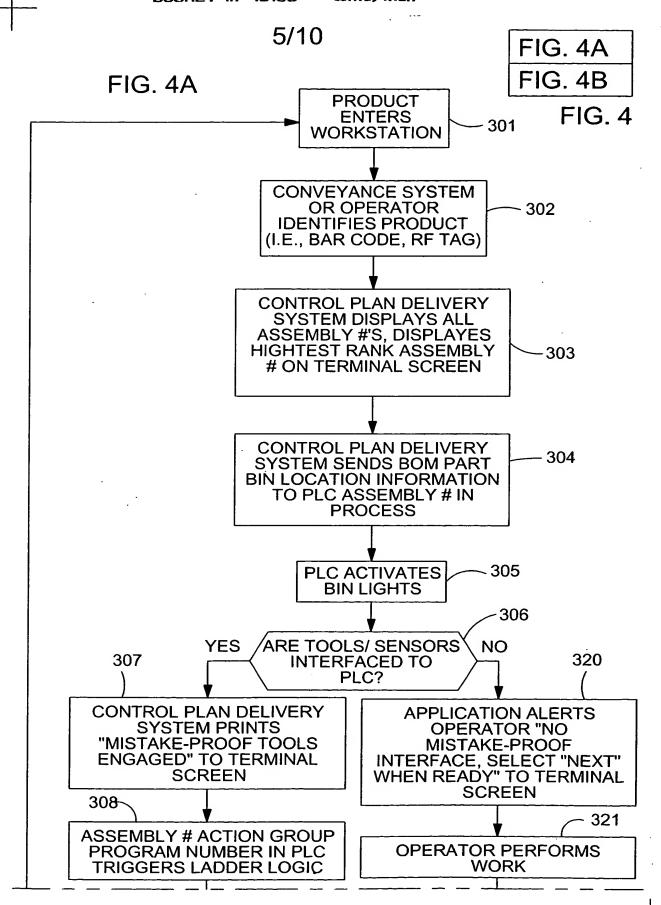
↓

OPERATOR PERFORMS WORK — 321

TITLE: INFINITELY VARIABLE, ORDER
SPECIFIC, HOLISTIC ASSEMBLY
PROCESS CONTROL SYSTEM
INVENTOR: Vern Hoppes, et. al.
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FIG. 3B   4/10

PLC ACTIVATES PROPER INTERFACES (I.E. LIGHTS FOR ORIENTATION, MONITOR TOOL INPUTS FOR USAGE, BIN MOTION SENSOR, AS REQUIRED)

309

OPERATOR SENDS "NEXT" MESSAGE TO CONTROL PLAN DELIVERY SYSTEM

322

APPLICATION SENDS MESSAGE TO TERMINAL STATING WHAT IS INCOMPLETE

317

310

OPERATOR PERFORMS WORK — NO

YES

311

YES

PLC SENDS "NEXT" MESSAGE TO CONTROL PLAN DELIVERY SYSTEM

NO

OPERATOR TRIES TO SEND "NEXT" MESSAGE

314

318

OPERATOR CONTACTS DEPT SUPERVISOR

315

APPLICATION CHECKS PLC ADDRESS TO VERIFY WORK COMPLETE — NO

319

DEPT SUPERVISOR OR APPOINTEE PUTS MISTAKE-PROOF ON OVERRIDE, CONTACTS MAINTENANCE

YES

APPLICATION SENDS "NEXT" MESSAGE TO CONTROL PLAN DELIVERY SYSTEM

316

312

NO — ARE ALL ASSEMBLIES COMPLETE?

YES

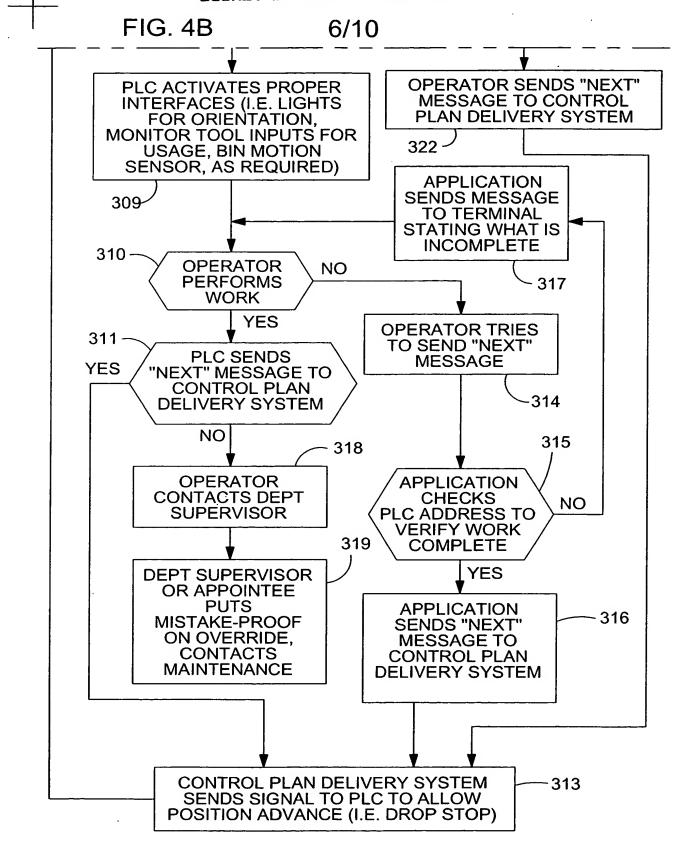CONTROL PLAN DELIVERY SYSTEM SENDS SIGNAL TO PLC TO ALLOW POSITION ADVANCE (I.E. DROP STOP)

313

TITLE: INFINITELY VARIABLE, ORDER
SPECIFIC, HOLISTIC ASSEMBLY
PROCESS CONTROL SYSTEM
INVENTOR: V rn H ppes, et. al.
DOCKET #: 16166   -wmd, mah

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FIG. 4A

FIG. 4A
FIG. 4B

FIG. 4

```
PRODUCT
ENTERS          —— 301
WORKSTATION
   │
   ▼
CONVEYANCE SYSTEM
OR OPERATOR
IDENTIFIES PRODUCT   —— 302
(I.E., BAR CODE, RF TAG)
   │
   ▼
CONTROL PLAN DELIVERY
SYSTEM DISPLAYS ALL
ASSEMBLY #'S, DISPLAYES   —— 303
HIGHTEST RANK ASSEMBLY
# ON TERMINAL SCREEN
   │
   ▼
CONTROL PLAN DELIVERY
SYSTEM SENDS BOM PART
BIN LOCATION INFORMATION   —— 304
TO PLC ASSEMBLY # IN
PROCESS
   │
   ▼
PLC ACTIVATES   —— 305
BIN LIGHTS
   │
   ▼
```

306
ARE TOOLS/ SENSORS
YES — INTERFACED TO — NO
PLC?

307

CONTROL PLAN DELIVERY
SYSTEM PRINTS
"MISTAKE-PROOF TOOLS
ENGAGED" TO TERMINAL
SCREEN

320

APPLICATION ALERTS
OPERATOR "NO
MISTAKE-PROOF
INTERFACE, SELECT "NEXT"
WHEN READY" TO TERMINAL
SCREEN

308

ASSEMBLY # ACTION GROUP
PROGRAM NUMBER IN PLC
TRIGGERS LADDER LOGIC

321

OPERATOR PERFORMS
WORK

TITLE: INFINITELY VARIABLE, ORDER
SPECIFIC, HOLISTIC ASSEMBLY
PROCESS CONTROL SYSTEM
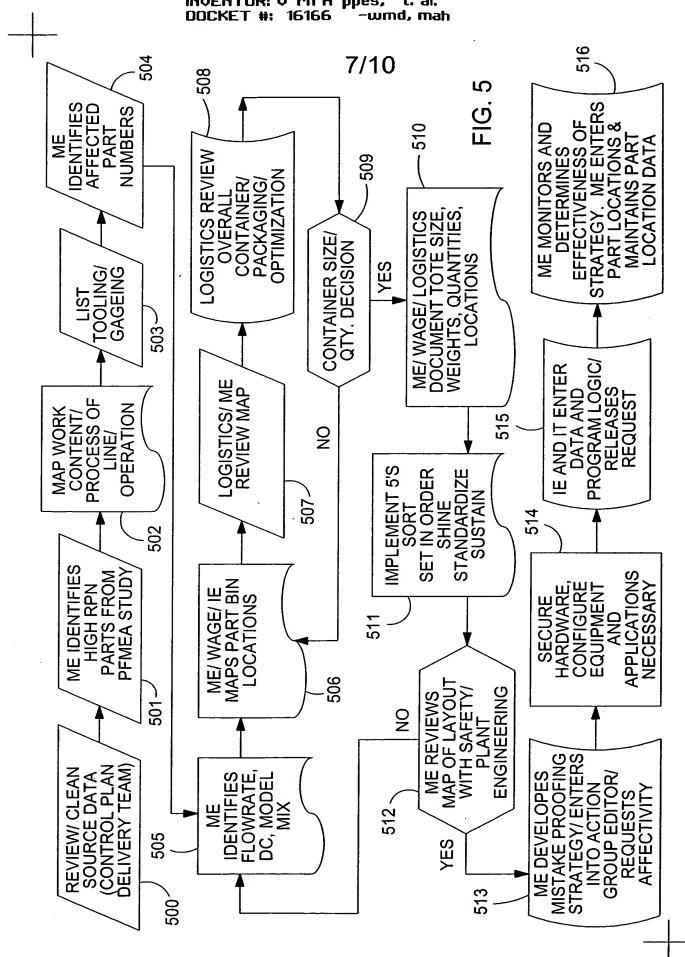INVENTOR: V rn Hopp s, et. al.
DOCKET #: 16166   -wmd, mah

FIG. 4B   6/10

PLC ACTIVATES PROPER INTERFACES (I.E. LIGHTS FOR ORIENTATION, MONITOR TOOL INPUTS FOR USAGE, BIN MOTION SENSOR, AS REQUIRED)
309

OPERATOR SENDS "NEXT" MESSAGE TO CONTROL PLAN DELIVERY SYSTEM
322

APPLICATION SENDS MESSAGE TO TERMINAL STATING WHAT IS INCOMPLETE
317

310 OPERATOR PERFORMS WORK — NO / YES

311 PLC SENDS "NEXT" MESSAGE TO CONTROL PLAN DELIVERY SYSTEM — YES / NO

OPERATOR TRIES TO SEND "NEXT" MESSAGE
314

318 OPERATOR CONTACTS DEPT SUPERVISOR

315 APPLICATION CHECKS PLC ADDRESS TO VERIFY WORK COMPLETE — NO / YES

319 DEPT SUPERVISOR OR APPOINTEE PUTS MISTAKE-PROOF ON OVERRIDE, CONTACTS MAINTENANCE

APPLICATION SENDS "NEXT" MESSAGE TO CONTROL PLAN DELIVERY SYSTEM
316

CONTROL PLAN DELIVERY SYSTEM SENDS SIGNAL TO PLC TO ALLOW POSITION ADVANCE (I.E. DROP STOP)
313

TITLE: INFINITELY VARIABLE, ORDER
SPECIFIC, HOLISTIC ASSEMBLY
PROCESS CONTROL SYSTEM
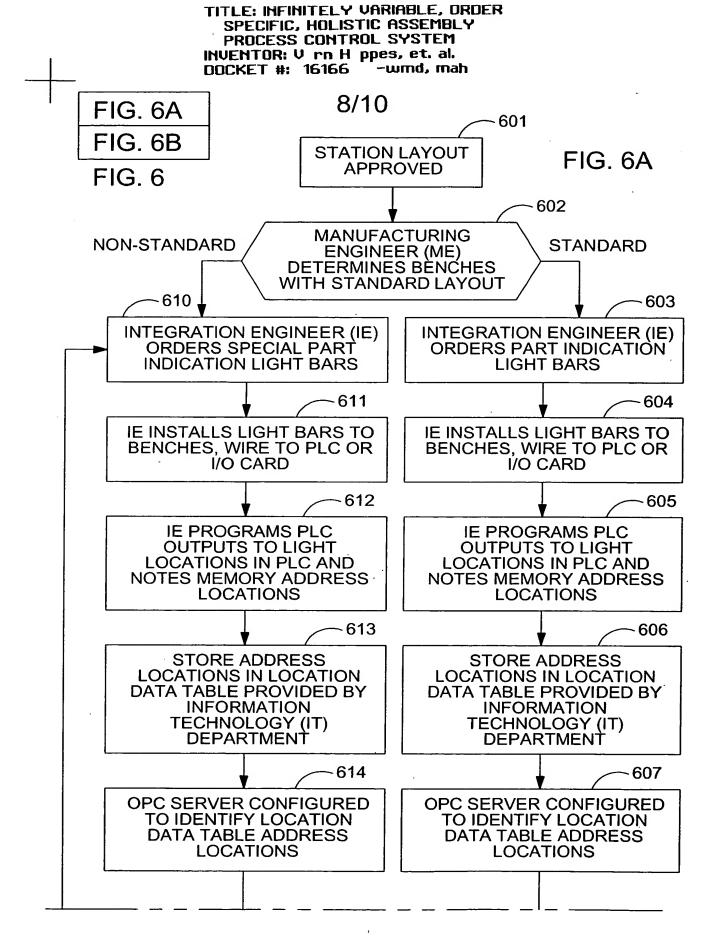INVENTOR: V rn H ppes, t. al.
DOCKET #: 16166   -wmd, mah

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FIG. 5

504 — ME IDENTIFIES AFFECTED PART NUMBERS

503 — LIST TOOLING/ GAGEING

502 — MAP WORK CONTENT/ PROCESS OF LINE/ OPERATION

501 — ME IDENTIFIES HIGH RPN PARTS FROM PFMEA STUDY

500 — REVIEW/ CLEAN SOURCE DATA (CONTROL PLAN DELIVERY TEAM)

505 — ME IDENTIFIES FLOWRATE, DC, MODEL MIX

508 — LOGISTICS REVIEW OVERALL CONTAINER/ PACKAGING/ OPTIMIZATION

507 — LOGISTICS/ ME REVIEW MAP

506 — ME/ WAGE/ IE MAPS PART BIN LOCATIONS

509 — CONTAINER SIZE/ QTY. DECISION

NO

YES

510 — ME/ WAGE/ LOGISTICS DOCUMENT TOTE SIZE, WEIGHTS, QUANTITIES, LOCATIONS

511 — IMPLEMENT 5'S SORT SET IN ORDER SHINE STANDARDIZE SUSTAIN

512 — ME REVIEWS MAP OF LAYOUT WITH SAFETY/ PLANT ENGINEERING

NO

YES

513 — ME DEVELOPES MISTAKE PROOFING STRATEGY/ ENTERS INTO ACTION GROUP EDITOR/ REQUESTS AFFECTIVITY

514 — SECURE HARDWARE, CONFIGURE EQUIPMENT AND APPLICATIONS NECESSARY

515 — IE AND IT ENTER DATA AND PROGRAM LOGIC/ RELEASES REQUEST

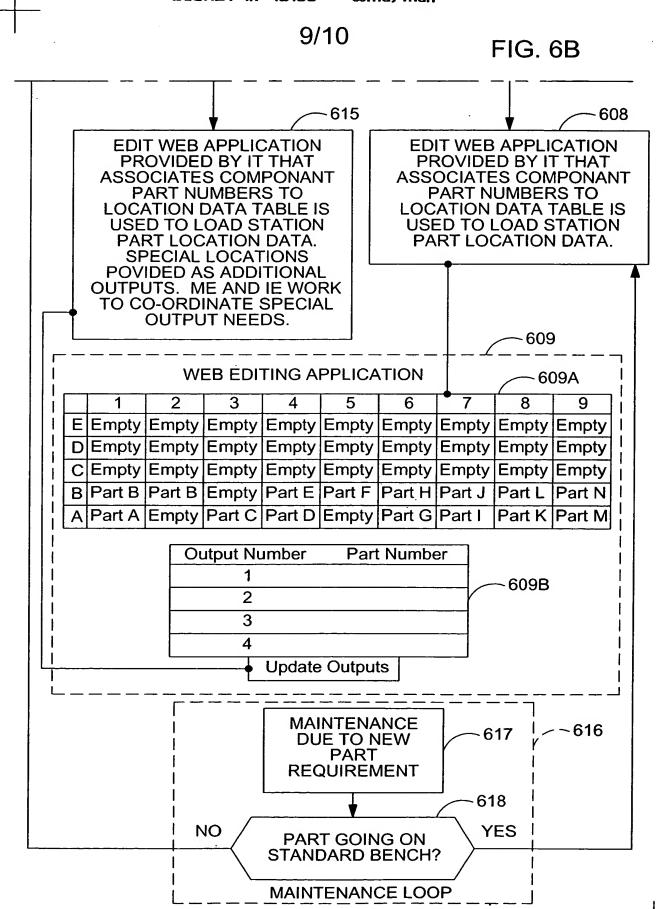516 — ME MONITORS AND DETERMINES EFFECTIVENESS OF STRATEGY. ME ENTERS PART LOCATIONS & MAINTAINS PART LOCATION DATA

TITLE: INFINITELY VARIABLE, ORDER
SPECIFIC, HOLISTIC ASSEMBLY
PROCESS CONTROL SYSTEM
INVENTOR: V rn H ppes, et. al.
DOCKET #: 16166   -wmd, mah

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FIG. 6A
FIG. 6B

FIG. 6

FIG. 6A

601
STATION LAYOUT
APPROVED

602
MANUFACTURING
ENGINEER (ME)
DETERMINES BENCHES
WITH STANDARD LAYOUT

NON-STANDARD ← → STANDARD

610
INTEGRATION ENGINEER (IE)
ORDERS SPECIAL PART
INDICATION LIGHT BARS

603
INTEGRATION ENGINEER (IE)
ORDERS PART INDICATION
LIGHT BARS

611
IE INSTALLS LIGHT BARS TO
BENCHES, WIRE TO PLC OR
I/O CARD

604
IE INSTALLS LIGHT BARS TO
BENCHES, WIRE TO PLC OR
I/O CARD

612
IE PROGRAMS PLC
OUTPUTS TO LIGHT
LOCATIONS IN PLC AND
NOTES MEMORY ADDRESS
LOCATIONS

605
IE PROGRAMS PLC
OUTPUTS TO LIGHT
LOCATIONS IN PLC AND
NOTES MEMORY ADDRESS
LOCATIONS

613
STORE ADDRESS
LOCATIONS IN LOCATION
DATA TABLE PROVIDED BY
INFORMATION
TECHNOLOGY (IT)
DEPARTMENT

606
STORE ADDRESS
LOCATIONS IN LOCATION
DATA TABLE PROVIDED BY
INFORMATION
TECHNOLOGY (IT)
DEPARTMENT

614
OPC SERVER CONFIGURED
TO IDENTIFY LOCATION
DATA TABLE ADDRESS
LOCATIONS

607
OPC SERVER CONFIGURED
TO IDENTIFY LOCATION
DATA TABLE ADDRESS
LOCATIONS

TITLE: INFINITELY VARIABLE, ORDER
SPECIFIC, HOLISTIC ASSEMBLY
PROCESS CONTROL SYSTEM ·
INVENTOR: V rn Hoppe , et. al.
DOCKET #: 16166   —wmd, mah

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FIG. 6B

615

EDIT WEB APPLICATION PROVIDED BY IT THAT ASSOCIATES COMPONANT PART NUMBERS TO LOCATION DATA TABLE IS USED TO LOAD STATION PART LOCATION DATA. SPECIAL LOCATIONS POVIDED AS ADDITIONAL OUTPUTS. ME AND IE WORK TO CO-ORDINATE SPECIAL OUTPUT NEEDS.

608

EDIT WEB APPLICATION PROVIDED BY IT THAT ASSOCIATES COMPONANT PART NUMBERS TO LOCATION DATA TABLE IS USED TO LOAD STATION PART LOCATION DATA.

609

WEB EDITING APPLICATION

609A

	1	2	3	4	5	6	7	8	9
E	Empty	Empty	Empty	Empty	Empty	Empty	Empty	Empty	Empty
D	Empty	Empty	Empty	Empty	Empty	Empty	Empty	Empty	Empty
C	Empty	Empty	Empty	Empty	Empty	Empty	Empty	Empty	Empty
B	Part B	Part B	Empty	Part E	Part F	Part H	Part J	Part L	Part N
A	Part A	Empty	Part C	Part D	Empty	Part G	Part I	Part K	Part M

Output Number	Part Number
1	
2	
3	
4	

609B

Update Outputs

MAINTENANCE DUE TO NEW PART REQUIREMENT

617

616

618

NO ← PART GOING ON STANDARD BENCH? → YES

MAINTENANCE LOOP

TITLE: INFINITELY VARIABLE, ORDER
SPECIFIC, HOLISTIC ASSEMBLY
PROCESS CONTROL SYSTEM
INVENTOR: V rn Hoppes, et. al.
DOCKET : 16166   -wmd, mah

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FIG. 7

MANUFACTURING ENGINEER (ME) DETERMINES FROM PFMEA MISTAKE PROOFING NEEDED — 701

ARE MISTAKE PROOFING STRATEGY REQUIREMENTS NEW? — 702 → **NO** → IN WEB APPLICATION ASSIGN NEW ASSEMBLY NUMBER TO ACTION GROUP THAT EXISTS — 713

YES

IN WEB APPLICATION ASSIGN NEW ASSEMBLY NUMBER TO ACTION GROUP THAT EXISTS — 713 → REQUEST EFFECTIVE DATE — 714

DOES EXISTING STRATEGY EXIST THAT IS SIMILAR? — 703 → **NO** → IN WEB APPLICATION CREATE NEW ACTIONS AS NEEDED. DESCRIBE FUNCTIONS, CREATE ERROR MESSAGES THAT DESCRIBES FAILURES — 704

YES

IN WEB APPLICATION CREATE NEW ACTIONS AS NEEDED. DESCRIBE FUNCTIONS, CREATE ERROR MESSAGES THAT DESCRIBES FAILURES — 711

IN WEB APPLICATION CREATE NEW ACTION GROUP AS NEEDED. DESCRIBE FUNCTION, ASSIGN NEW ACTIONS. ASSIGN ASSEMBLY NUMBERS TO ACTION GROUP. — 705

IN WEB APPLICATION CREATE NEW ACTION GROUP AS NEEDED. DESCRIBE FUNCTION, ASSIGN NEW ACTIONS AND EXISTING ACTIONS TO ACTION GROUP. ASSIGN ASSEMBLY NUMBERS TO ACTION GROUP. — 712

REQUEST EFFECTIVE DATE — 706

OPC SERVER CONFIGURED TO IDENTIFY LOCATION DATA TABLE ADDRESS LOCATIONS — 709

INTEGRATION ENGINEER (IE) WORKS WITH ME TO IMPLIMENT HARDWARE AND PLC LOGIC DEVELOPMENT FOR NEW ACTIONS ASSIGN LOGIC ADDRESS FOR NEW ACTION GROUP. — 707

SET ENABLE DATE — 710

STORE ADDRESS LOCATIONS IN LOCATION DATA TABLE PROVIDED BY INFORMATION TECHNOLOGY (IT) DEPARTMENT — 708